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Also if P be equivalent to an annuity certain of t years, so that $P = \frac{1-v^t}{r}$, and therefore $p = v^{t+1}$, then (12) becomes

$$f \frac{a+b+c+\dots}{1-v^{t+1}},$$

which is Mr. Milne's expression.

The formula (13) is not in Milne, but is given by Professor De Morgan in his *Essay on Probabilities* (*Cab. Cyclop.*), Appendix the Second. It is very well adapted to computation, though not I think quite so well as (12), if Jones's tables previously alluded to be used. The difference between the two formulas in point of practical application is, however, very trifling.

Eighth Census of the United States, in 1860. By SAMUEL BROWN, Esq., V.P.S.S.

IN the course of last year a very important document was published by the American Government, under the direction of the Secretary of the Interior, entitled "Statistics of the United States (including Mortality, Property, &c.) in 1860; compiled from the original Returns, and being the final Exhibit of the Eighth Census." It contains an introduction by J. M. Edmunds, Commissioner of General Land Office, in charge of census, and a still fuller introduction to the mortality statistics for the year ending June 1st, 1860, by Dr. Edward Jarvis, a very able writer, who was a delegate to the Statistical Congress, when it was held in London, and is a Corresponding Member of the Statistical Society of London.

The former introduction gives a brief notice of the census as taken in different countries (commencing with the enumeration of the people under the Mosaic Dispensation) to the first census of the United States, in 1790. Since that time there has been one every 10 years, and a short sketch is given of the legal enactments by which they were carried out. The statute of 23rd May, 1850, by which the seventh census was ordered, also made provision for the eighth and any subsequent census, which was supplemented in 1860 and 1862 by some Acts which required, amongst other things, the Secretary of War to be furnished with such war statistics as might be needed, and gave a credit of two millions of dollars = £400,000 for the necessary expenses, including the costs of printing and binding.

It does not appear clear from this Report whether the census was to be taken for any single day, or, better still, for any single night; but merely that the schedules, after being sent out to the marshals, were to be returned by some specified date. If so, the results are liable to all the errors arising from many persons and facts being counted twice over, and some not being included at all. The actual population might therefore be very different, except under the extreme improbability that the changes of population on different days were exactly in the same proportion at all ages.

The forms of schedules comprise classifications for the produce of agriculture, of industry, social statistics, public libraries, periodicals, newspapers, pauperism, crime, cost of labour, religious worship, and mortality statistics.

Before giving a brief summary of the last, which are likely to be more especially interesting to the readers of this *Journal*, it may be well to quote the remarkable figures which form the totals of some of the preceding heads of classification.

Population.—At the close of the sixteenth century, the regions comprised within the limits of the United States were described as a wilderness, untrodden by civilized man.

A century after, in the year 1700, the inhabitants of the Anglo-American colonies are stated to be	262,000
In 1749–50, the estimated population was	1,000,000
In 1775, estimated by Congress in view of the approaching rupture	2,389,000
In 1790, at the first census according to law	3,930,000
In 1860, by the eighth census, computed to be	31,443,000

Agriculture.—Under the Act of 1798, the number of acres assessed for direct taxes, independent of lands belonging to the United States, or exempted from taxation, and exclusive of Louisiana, amounted to 163,747,000 acres, and valued at 479,293,000 dollars = £95,859,000. In 1809, the *improved* lands in the United States, including pastures, embraced 63,570,000 acres. In 1860, the lands are thus stated—

	Improved, in Farms. Acres.	Unimproved. Acres.	Cash Value. Dollars.	£
In the States	162,650,000	241,944,000	6,631,520,000 =	1,326,304,000
In the Territories	461,000	2,158,000	13,525,000 =	2,705,000
Total	163,111,000	244,102,000	6,645,045,000 =	1,329,009,000

In 1850, the number of acres of improved lands was 113,033,000, and the cash value of farms, 3,271,575,000 dollars = £654,315,000,

showing an increase in the 10 years of 44 per cent. in improved lands, and more than 50 per cent. in the values.

Manufactures.—As to the annual value of manufactured products, the estimates at all the periods must be somewhat more than vague. Up to 1790, they were mostly confined to those of the household class, although the manufactures of iron and its ultimate products, coarse woollens, and papers, were becoming greatly extended by means of joint stock and incorporated Companies. From 1810 to 1860, the product is stated in the volume for manufactures to have increased from 198,613,000 dollars = £39,723,000 in the former year to the enormous sum of 2,000,000,000 dollars = £400,000,000 in 1860.

The fourth volume of the census for 1860 treats of

Mortality.—This subject is more fully discussed in the Report of Dr. Jarvis, who has taken much pains to classify the deaths, not merely as to age and sex, and whether of the white or coloured population, but to give the causes of death and the diseases of the two races according to the subdivisions adopted in the English Registration Office and other continental returns. There is great reason, however, to doubt the accuracy of the facts collected by the census officers as to the deaths in the course of the preceding year, except where they are confirmed by a previously-existing system of registration. The general result is stated to be that, in 1850, with a population of 23 millions, 323,000 persons died, or 14 per 1,000; whilst in 1860, with a population of 31½ millions, only 394,000 deaths occurred, or 12½ per 1,000; both proportions so low as to suggest the idea either that some serious error has been committed, or that some fuller explanations are required as to the causes. Yet the conclusion in the report is that with such a rapid increase of rate of population over rate of mortality, “the beginning of the year 1900 will find within the present limits of this Republic 107 millions of inhabitants.”

Banks.—On the 1st January, 1811, the whole number of banks in the United States was 88, their aggregate capital 22,700,000 dollars = £4,500,000, and of specie 9,600,000 dollars = £1,920,000. In 1850 there were 872 banks, capital 227 millions of dollars = £45,400,000; and in 1860, 1,562, with a capital of 421 millions of dollars = £84,200,000.

On the 1st January, 1866, the amount estimated was 380 millions of dollars of National Bank notes = £76,000,000, 80 millions of dollars = £16,000,000 from State Banks, 129 millions of dollars = £25,800,000, supposed to have been issued since 1st October,

1865, to National Banks ; whilst the gold and silver products from mines, for the year ending 30th June, 1865, were 100 millions of dollars = £20,000,000, and the receipts into the Treasury for that year amounted to 929½ millions of dollars = £185,900,000.

Insurance.—The earliest Insurance Offices in America are supposed to be one established at Boston in 1724, and one in Philadelphia in 1756.

In 1860 the number of Insurance Companies in the United States was 294 ; their capitals and assets 82,170,000 dollars = £16,434,000 ; at risk, 2,605½ millions of dollars = £521,100,000 ; losses in marine and fire branches in 1860, 50,596,000 dollars = £10,119,000.

For life assurance there were 47 Offices, embracing 60,000 lives, with assurances for 180 millions of dollars = £36,000,000 ; the annual premiums being stated to be 7 millions of dollars = £1,400,000, which, if correct, would be very much in excess of the average rate in this country, unless there is comprised in that item the interest from investments also.

Railroads and canals.—In 1860 the commercial railroads are reported to have a total length of 30,794 miles, and the cost of construction to have been 1,151½ millions of dollars = £230,300,000 ; whilst the city passenger railways were equal to 403 miles, costing 14,863,000 dollars = £2,972,600.

The first canal completed in the United States was the Middlesex, between Boston Harbour and Concord River, 27 miles in length, which was constructed, at a cost of 550,000 dollars = £110,000, by a Company incorporated in 1789. In 1860 there were 118 canals, having a total length of 5,462 miles ; the cost of construction in 68 of which was 147,400,000 dollars = £29,475,000, the cost of the remainder not being reported.

Value of real and personal property.—In 1789 the total property valuation for taxation consisted of 163,750,000 acres and 277,000 houses, together valued at 620 millions of dollars = £124,000,000. In 1850 the estimate of value rose to 7,136 millions of dollars = £1,427,160,000 ; whilst in 1860, according to the marshals' returns, the value had risen to 16,160 millions of dollars = £3,232,000,000. The aggregate of the individual returns of real and personal private property in the country is still higher, making the estimate 19,089 millions of dollars = £3,817,800,000.

Educational establishments.—The total number of educational establishments in 1860, including collegiate, academies, and public schools was 113,000, in which were employed 149,000 teachers,

giving instruction to 5,418,000 persons, and possessing a total annual income of 33,990,000 dollars = £6,798,000. The number of libraries returned in 1860 was 27,730, with 13,316,000 volumes.

Religious establishments.—The returns in 1860 gave 54,000 churches, the value of their property being 172 millions of dollars = £34,400,000; being capable of affording accommodation to 18,975,000 persons, averaging one church to every 584 individuals in the whole population.

Manufactures, postal transit, and the press.—It is stated that in 1860 there were amongst the large towns 102, which contained an aggregate population of 4,764,000, with a manufacturing capital of 417 millions of dollars = £83,400,000, employing upwards of 557,000 persons; and the value of the manufactured produce realized the sum of 875 millions of dollars = £175,000,000.

The postal service is given to a more recent date, the beginning of the fiscal year 1865, when it embraced 6,012 routes, of an aggregate length of 142,000 miles, at a total cost of 6,803,000 dollars = £1,360,000; the aggregate transportation being equal to 57,993,000 miles.

The power of the public press is well known in America, and it seems to be growing with increased rapidity, for whereas in 1850 there were reported 2,526 newspapers of all kinds, with a circulation of 426,409,000, in 1860 they amounted to 4,051 newspapers, with an annual circulation of 928 millions of copies. The annual receipts of a single leading paper are stated to be more than one million of dollars, or £200,000. The first journal published in the Anglo-American Colonies was the *Boston Newsletter*, in 1704; and at the opening of the revolution only 40 newspapers were in existence.

Army and Navy.—The summary of the army and navy is not given according to the census year—a year of peace, but a comparison is made at different *war periods*, in 1775, 1812, and 1865. At the last date, on the 10th March, the navy is stated to consist of 684 ships of war, with 4,477 guns, and an aggregate tonnage of 519,000 tons. At the end of 1864 the naval service is said to have comprised 6,000 officers and 45,000 men.

The number of men raised for the service of the Union armies during the late war is computed at nearly 2,688,000, though no doubt this comprises the numbers actually voted, and probably large deductions would have to be made for such as did not appear in the field. From the actual number returned must also be taken off many who enlisted and received bounty money more than once. Including the Confederate armies, 4,000,000 of men are computed

to have engaged in the civil war, or nearly one-seventh of the whole population.

In all the above quoted large numbers and values the figures have been expressed in the nearest thousands, as quite sufficiently accurate for the picture presented by this census of the remarkable progress and material prosperity of the great American nation. These results are, of course, only the summaries of numerous tables. The details are given with much minuteness, and show the vast variety of information as to the condition of a people which a census, if accurately taken, is capable of affording. The Report by Dr. Jarvis, on the mortality statistics, involves some points of such great and curious interest, especially as regards the white and coloured populations, that it may be worth analyzing separately on a future occasion.

A Budget of Paradoxes. By PROFESSOR DE MORGAN.

(Continued from page 188.)

No. XVIII. 1847—1849.

Aerial Navigation; containing a description of a proposed flying machine, on a new principle. By Dædalus Britannicus. London, 1847, 8vo.

In 1842-43 a Mr. Henson had proposed what he called an aeronaut steam-engine, and a Bill was brought in to incorporate an "Aerial Transit Company." The present plan is altogether different, the moving power being the explosion of mixed hydrogen and air. Nothing came of it—not even a Bill. What the final destiny of the balloon may be no one knows: it may reasonably be suspected that difficulties will at last be overcome. Darwin, in his *Botanic Garden* (1781), has the following prophecy:—

"Soon shall thy arm, unconquered Steam! afar
Drag the slow barge, or drive the rapid car;
Or, on wide-waving wings expanded, bear
The flying chariot through the fields of air."

Darwin's contemporaries, no doubt, smiled pity on the poor man. It is worth note that the two true prophecies have been fulfilled in a sense different from that of the predictions. Darwin was thinking of the suggestion of Jonathan Hulls, when he spoke of dragging the slow barge: it is only very recently that the steam-tug has been employed on the canals. The car was to be driven, not drawn, and on the common roads. Perhaps, the flying chariot will be something of a character which we cannot imagine, even with the two prophecies and their fulfilments to help us.